

The partner of choice for science and technology leaders.

2019

INTERNATIONAL SCIENCE PROSPECTUS

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FROM GLOBAL'S COMMAND

Welcome

This is our International Science Prospectus for FY19, which covers international networking, collaborations, and fundamental research grants having Naval relevance. International science tools utilized by our Science Directors are provided along with the countries, university and institution partnerships, technology areas, and co-funding sources covered by each tool (the breadth of Global).

Additionally, the Addendum provides a total portfolio listing of all on-going and new investments throughout the fiscal year (the depth of Global). The goal we have in providing this is to increase and enable Global's corporate international science awareness, engagement, and opportunities with you. Notable objectives include the following:

- Ability to keyword search for areas of interest throughout this Prospectus
- Provide connections with our Science Director SMEs to exchange ideas and paths forward (future collaborations)
- Provide investment engagement details and published material via the DTIC website or via coordination with our Science Director SMEs.
- Consider areas of interest at the university-institute level

Please contact us if you have any questions, feedback, recommendations, or engagement-leverage opportunities.

Sincerely,

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ONR GLOBAL MISSION

To serve as the enduring Navy and Marine Corps global presence in technical and operational communities, investing in trusted partnerships to discover and connect science and technology leaders for sustained maritime security.

INTERNATIONAL SCIENCE TECHNICAL STAFF

ONR Global's technical staff consists of a Technical Director, 24 Science Directors, and 2 Military Regional Directors. Science Directors act as a technical broker linking the Office of Naval Research (ONR), Naval Research Laboratory (NRL), and the Naval Research Enterprise (NRE) with International Science and Technology (S&T). Professional attributes include having doctorate degrees in relevant fields, experience with the NRE, foreign language skills, and international S&T experience. Our Global on-site locations include the following:

- Melbourne (Opened November 2019)
- London (includes Technical Director and Regional Director)
- Prague
- Tokyo (includes Regional Director)
- Santiago
- Singapore
- Sao Paulo

This organization composition and placement is in alignment with the National Defense Strategy's understanding of worldwide S&T trends. Science Directors - in addition to their locations - are assigned countries to monitor covering the following footprint (includes COCOM Partnerships):

- Europe+: Austria, Baltics, Belgium, Croatia, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Netherlands, Norway, Poland, Portugal, Russia, Slovakia, Spain, Sweden, Switzerland, Turkey, UK, Ukraine
- Indo-Pacific: Australia, China, Hong Kong, Indonesia, India, Japan, Macau, Malaysia, New Zealand, Philippines, Republic of Korea, Russia (Far East), Singapore, Taiwan, Thailand, Vietnam
- Middle East/Africa
- Americas: Argentina, Brazil, Canada, Chile, Colombia, Mexico, Peru

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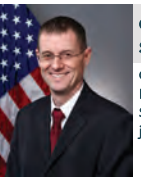
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FRAMEWORK

International Science Having Naval Relevance

International science priorities and naval relevance comes from the following guidance:

1. NRE R&D Framework (ONR, DC): A Framework for the Navy & Marine Corps After Next

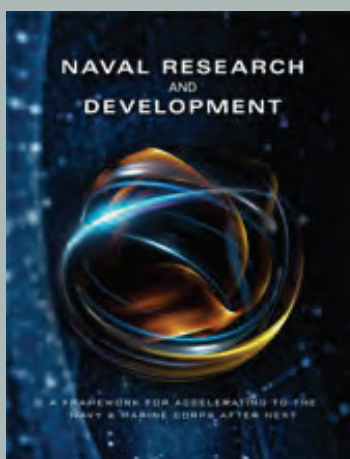
- 5 Integrated Research Portfolios
- 5 Actionable Technology Priorities

2. Under Secretary of Defense for Research and Engineering USD (R&E), (OSD, DC); Technical Domain Priorities

- 10 Areas having Naval applicability

NRE INTEGRATED PORTFOLIOS

- Information, Cyber and Spectrum Security
- Ocean Battlespace and Expeditionary Access
- Mission Capable, Persistent and Survivable Naval Platforms
- Aviation, Force Projection and Integrated Defense
- Warfighter Performance



NRE TECHNICAL PRIORITIES

- Augmented Warfighter
- Operational Endurance
- Integrated & Distributed Forces
- Sensing & Sense Making
- Scalable Lethality

DoD Modernization Priorities

- Hypersonics
- Fully Networked Command, Control, and Communication
- Space
- Autonomy
- Directed Energy
- Cyber
- Quantum Science
- Microelectronics
- Biotechnology
- Machine Learning/Artificial Intelligence
- 5G



For more information, visit <https://www.cto.mil/modernization-priorities/>

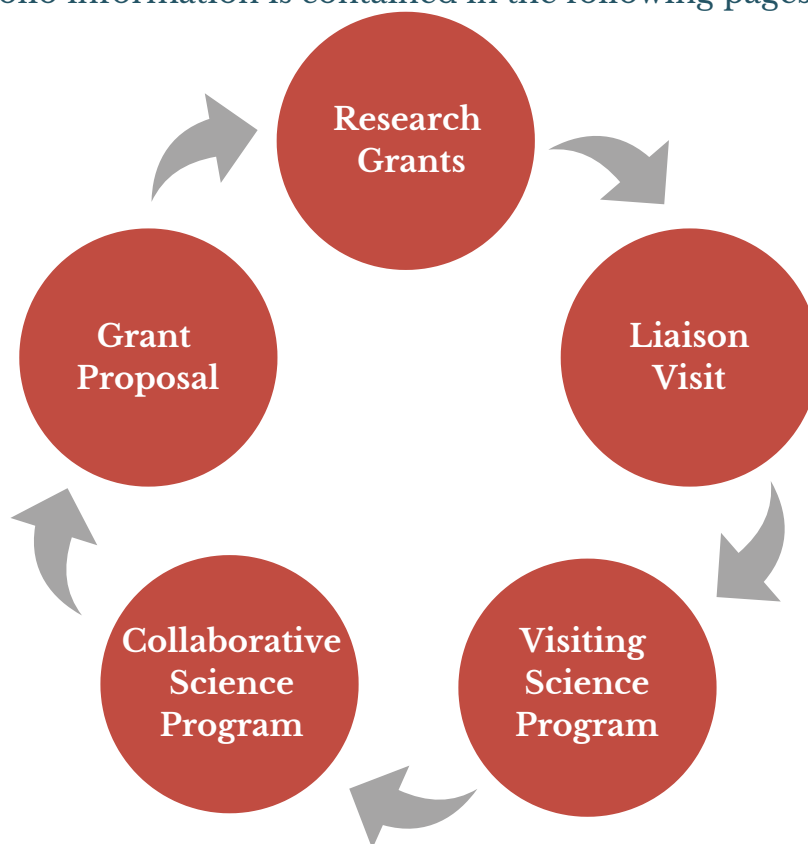
a year's overview

INTERNATIONAL SCIENCE TOOLS

International science tools available to ONR Global's technical staff include the following:

1. Liaison Visits
2. Visiting Scientist Program (VSP)
3. Collaborative Science Program (CSP)
4. Research Grants*

Specific FY19 portfolio information is contained in the following pages.



Small, early investments can lead to significant results.

*Research grants were formally known as Naval International Cooperative Opportunities Programs (NICOP).

INTERNATIONAL SCIENCE TOOL: LIAISON VISITS

ONR Global's technical staff attend international events and visit international institutions to develop, access, and discover cutting edge Science and Technology (S&T). These international science networking liaison visits are the primary tool in monitoring overall Global Technical Awareness (GTA). Additionally, they can foster future VSP, CSP, and Research Grant opportunities. For FY19, ONR Global had 130 Liaison Visits across 47 countries.

For FY19, ONR Global had 130 Liaison Visits across 47 countries. GTA related areas included the following (sample):

- Acoustics and Undersea Technologies
- AI, Machine Learning, Human-Machine, Robotics, Autonomy & Swarm Autonomy
- Arctic, Antarctic
- Biology & Biotechnologies
- Command, Control, & Communications (C3)
- Cyber
- Data Science
- Directed Energy
- Environmental Science
- Hypersonic
- Information Science
- Marine Science & Oceanography
- Material Science including Coatings, Structural, Nano & Metamaterials
- Microelectronics
- Operational Energy
- Optics & Sensors
- Physics including Statistical and Plasma
- Synthetic Biology
- Quantum Science & Technologies



COUNTRIES

Argentina	Czech Republic	Indonesia	Oman	Sweden
Australia	Denmark	Israel	Peru	Switzerland
Belgium	Dominican Republic	Italy	Qatar	Taiwan
Brazil	Ecuador	Japan	Republic of Korea	Thailand
Brunei	El Salvador	Kenya	Romania	Ukraine
Chile	France	Malaysia	Russia	United Kingdom
China	Germany	Mexico	Singapore	Vietnam
Colombia	Greece	Netherlands	Slovenia	
Costa Rica	Hungary	New Zealand	South Africa	
Croatia	India	Norway	Spain	

Liaison Visits

INSTITUTIONS

- Academia Sinica
- Acreo Research Institutes of Sweden (RISE)
- Babes-Bolya University
- Bandung Institute of Technology
- Ben-Gurion University
- Blekinge Institute of Technology
- Bogor Agricultural University
- Brighton, Inc.
- Bundeswehr Research Institute for Materials, Fuels and Lubricants
- Bundeswehr Technical Center for Ships and Naval Weapons
- CERN
- Chiang Mai University
- Curtin University
- Deakin University
- Defence Innovation Network
- Defence Innovation Partnership
- Defence Science and Technology Group (DSTG)
- Defence Science Institute
- Deimos Space
- ELI-ALPS, BEAMLINES, Nuclear Physics
- Escuela Politécnica Nacional
- Far Eastern Federal University
- Five Power Working Group NATO HQ
- Flinders University
- Fraunhofer-Gesellschaft
- Fraunhofer Institute for Manufacturing Technology and Advanced Materials
- Greek Ministry of Defence
- Haifa University
- Hanoi University of Science & Technology
- Hanyang University
- Imperial College
- India Institute of Science Bangalore
- India Institute of Technology (IIT) Delhi
- Indonesian Institute of Sciences
- Institute of Environmental and Resources
- Institute of Marine Environment and Resources
- Institute of Ocean Earth Sciences
- Institute of Oceanography
- Institute of Radiophysics
- International Society for Porous Media (Interpore)
- International University - VNU
- Istituto di Fotonica e Nanotecnologie (IFN)
- JAMSTEC
- Kochi Core Center
- Japan Advanced Institute of Science and Technology (JAIST)
- Japan Underwater and Seafloor Engineering Forum
- Kanazawa Institute of Technology (KIT)
- King Mongkut's Institute of Technology Ladkrabang
- Kochi University

130

Liaison Visits

47

Countries

- Korea University
- Kyoto University
- Laser Institute
- La Trobe University
- Lockheed Martin
- Ministry of Defence(Ukraine)
- Monash University
- Nansen Environmental Research Center (NERSC)
- Nanyang Technological University
- National Defence University of Malaysia
- National Kaohsiung University of S&T
- National Taiwan University
- National Tsinghua University
- National University of Singapore
- NATO Maritime Command
- Naval Academy (Romania)
- Osaka University
- Oxford University
- Pacific Oceanological Institute
- Pontifical Catholic University Madre y Maestra
- Pontificia Universidad Católica del Perú
- Pontificia Universidad Javeriana
- Pusan National University
- QinetiQ Farnborough Campus
- Queensland University of Technology



Liaison Visits

INSTITUTIONS

- Research Center for the Navy (Romania)
- RMIT University
- São Jose dos Campos (UNESP)
- Singapore University Technology and Design I-Trust
- South Atlantic Environmental Research Institute (SAERI)
- St. Andrews University
- State University of São Paulo
- Steller Systems
- Sultan Qaboos University
- Swinburne University
- Technical University of Delft
- Technical University of Munich (TUM)
- Technion - Israel Institute of Technology
- Tel Aviv University
- The Australian Defence Force Academy
- TNO-The Hague
- Universidad de Lima
- Universidad de Ciencia del Sur
- Universidad Peruano de Cayentano Heredia
- University of Adelaide
- University of Costa Rica
- Universidad de Buenos Aires
- Universidad del Nordeste (UNNE)
- Universidad de las Fuerzas Armadas-ESPE
- Universidad de los Andes
- Universidad Católica del Norte
- Universidad Nacional del Ingeniería
- Universidad San Francisco de Quito
- Universiti Brunei Darussalam
- University Putra Malaysia
- University of Cordoba

- University of Bucharest
- University of Cambridge
- University of College London
- University of Engineering Technology - VNU
- University of Malaya
- University of Malaysia
- University of Melbourne
- University of New South Wales
- University of Pardubice
- University of Portsmouth
- University of Science and Technology Hanoi (Vietnam)
- France University
- University of South Australia
- University of St. Andrews
- University of Sussex
- University of Sydney
- University of Technology and Design
- University of Technology Sydney
- University of Warwick
- VAST Institutes of Materials Science, Energy Science, Information Technology, Oceanography, Marine Environment and Ressources
- VNU HCMC University of S&T, Science, International, For Environment and Resources, and IT
- Vietnam German University
- Vlokh Institute of Physical Optics
- Waseda University
- West University of Timisoara
- Wigetworks Testing Site



INTERNATIONAL SCIENCE TOOL: VISITING SCIENTIST PROGRAM

ONR Global supports travel of foreign scientists to the US to socialize new S&T ideas or findings with the Naval Research Enterprise. For FY19, ONR Global had 40 Visiting Science engagements across 23 countries and 39 institutions-universities covering 11 main technology areas. See the following for portfolio information:

TECH DOMAINS

- Acoustics
- Autonomy & Unmanned
- Communications
- Human Systems
- Materials, Metamaterials and Composites
- Machine Learning
- Microelectronics
- Operational Energy
- Quantum Science
- Synthetic Biology
- Undersea Environment

COUNTRIES

- | | |
|-----------|----------------|
| Argentina | Latvia |
| Australia | Luxembourg |
| Austria | Mexico |
| Belgium | Netherlands |
| Brazil | New Zealand |
| Canada | Serbia |
| Chile | Singapore |
| France | Spain |
| Germany | Sweden |
| Indonesia | United Kingdom |
| Ireland | Vietnam |
| Italy | |



Visiting Science Program

PARTNERS

40

Science Engagements

23

Countries

- AMST -Systemtechnik GmbH
- Autonomous University of Nuevo Leon
- Consiglio Nazionale delle Ricerche (CNR)
- Dublin City University
- Ecole Polytechnique
- Federal University of Pernambuco
- Fraunhofer Institute
- Indonesian Institute of Sciences
- Institute of Oceanography
- Instituto Tecnológico de Buenos Aires
- McMaster University
- Nanyang Technological University (NTU)
- Nuytco Research Ltd.
- Osaka University
- Pompeu Fabra University
- Pontificia Universidade Católica do Rio de Janeiro (PUC-RJ)
- Research Institute of Sweden (RISE)
- Riga Technical University
- RMIT University

- Rural Federal University of Rio de Janeiro
- Sapienza Università di Roma
- The University of Queensland
- The University of Sydney
- Toyama Prefectural University
- Universidad de Chile
- Universidade Estadual de Campinas
- University College Cork
- University of Auckland
- University of Glasgow
- University of Luxembourg
- University of Portsmouth
- University of St Andrews
- University of Strathclyde
- University of Sussex
- University of Toronto
- University of Udine
- Vietnam National University of HCMC
- Vinča Institute for Nuclear Sciences
- Wageningen University



INTERNATIONAL SCIENCE TOOL: COLLABORATIVE SCIENCE PROGRAM

ONR Global supports foreign or international workshops and conferences having Naval interest. This international science networking tool can also foster future Liaison Visits, VSPs, and Research Grants along with providing overall Global Technical Awareness (GTA). For FY19, ONR Global had 58 Collaborative Science engagements across 28 countries and 51 institutions-universities covering 14 main technology areas. See the following for portfolio information:

TECH DOMAINS

- Acoustics and Undersea Technologies
- Additive Manufacturing
- AI, Machine Learning, Human-Machine, Robotics, Autonomy, & Swarm Autonomy
- Command, Control, & Communications (C3)
- Computer Science
- Data Science
- Environmental Science
- Material Science including Coatings, Energetic, Nano & Metamaterials
- Microelectronics
- Oceanography
- Operational Energy
- Optics & Sensors
- Synthetic Biology
- Quantum Science & Technologies

COUNTRIES

Australia	Malaysia
Austria	Mexico
Canada	Netherlands
Chile	New Zealand
Colombia	Peru
Czech Republic	Republic of Korea
France	Saudi Arabia
Georgia	Singapore
Germany	Spain
Greece	Switzerland
India	Taiwan
Israel	Thailand
Italy	United Kingdom
Japan	Vietnam

CO-FUNDING SOURCES

ONR HQ
Air Force
Army
DHS



Collaborative Science Program

PARTNERS

58

Science Engagements

28

Countries

- ATHENA SRL
- Curtin University of Technology
- Ecole Polytechnique Federale de Lausanne
- Forschungszentrum Jülich GmbH
- Foundation for Research and Technology Hellas (FORTH)
- Fraunhofer Institute IOSB
- Fundación Universidade da Coruña
- Helmholtz Institut for RNA Based Research
- Indian Institute of Science
- Indian Institute of Technology, Kanpur
- Industry University Cooperation Foundation: Hanyang University
- INRIA
- Institute for Nanotechnology
- Institute of Electrical & Electronics Engineers (USA) Singapore
- Institute of Materials Science
- Instituto de Física
- International Society of Mechatronic Engineering
- Ivane Javakhishvili Tbilisi State University
- Japan Advanced Institute of Science and Technology
- Japan Light Metal Welding Association
- JASCO AppliedSciences (Canada) Ltd.
- Korea Advanced Institute of Science and Technology
- Ludwig Boltzmann Gesellschaft - Österreichische Vereinigung
- Nanyang Technological University
- Naresuan University, School of Renewable Energy and Smart Grid Technology (SGtech)

- National Taiwan University
- National University of Singapore
- Nederlandse Organisatie Voor Toegepast-Natuurwetenschappelijk
- Newcastle University
- Ortra Ltd.
- Pohang University of Science and Technology
- Pontificia Universidad Catolica de Chile
- Royal Melbourne Institute Of Technology
- Singapore Space and Technology Association
- Technische Universität Dresden
- The Australian National University
- The University of Edinburgh
- The University Of Newcastle
- Universidad austral de Chile
- Universidad de Concepción
- Universidad Nacional de Colombia
- Università Degli Studi di Camerino
- Università degli Studi di Palermo
- Università Degli Studi Roma 3
- University of Glasgow
- University of Malaya
- University of New South Wales
- University of Tasmania
- Univerzita Pardubice
- Victoria University of Wellington
- VNU-HCM University of Science



Collaborative Science Program

ENGAGEMENTS

- ASGC5 - 5th ASEAN Smart Grid Congress
- Bioinspired materials: From understanding, through processing, to replication
- Computational approaches for long range imaging and sensing in scattering media
- Designer Biology Symposium
- Electric Field Enhanced Processing of Advanced Materials
- Future Trends in Synthetic Biology Asia
- Global Space and Technology Convention (GSTC) 2019 - Technical Sessions
- Hobart Isolated Power System (IPS) Connect 2019
- IEEE Wireless Communications and Networking Conference (WCNC 2019)
- India-USA Lecture Series On Aging Aircraft
- International Conference on Genomes and AI: From Packing to Regulation
- International Conference on Nonlinear, Quantum & Nanophotonics
- International Symposium on Frontiers of Translation Materials Science
- International Symposium on Piezocrystals and their Applications
- International Workshop on Propulsion, Sustainable Energy and Environment
- IQOE Workshop on Ocean Sound Monitoring Standards
- MarineComm: Workshop on communication technology transfer for Ocean science
- MEMRISYS 2019 - Third International Symposium on Memristive Systems
- Metamaterials 2019 - The Thirteenth International Congress on Artificial Materials for Novel Wave Phenomena
- Nanostructured plasmonic materials; and Emerging 2D materials and 2D heterostructures: synthesis, characterization and collective phenomena, on XXVIII International Materials Research Congress - IMRC 2019: symposia A1 and B1
- New Trends in Nonequilibrium Stochastic Multistable Systems and Memristors (NES2019)
- Pan American Research in Additive Global Manufacturing (PARADIGMA 2019)
- Quantum devices for non-classical light generation and manipulation
- Reliable Neuromorphic Perception and Control for Robotics (RNPC-R) Workshop
- Security and Resilience for Emerging Synthetic Biology and Biotechnology Threats
- The 12th IFAC Conference on Control Applications in Marine Systems, Robotics, and Vehicles (CAMS2019)
- The 15th Annual International Conference on Intelligent Unmanned Systems (ICIUS 2019)
- The 15th IEEE International Conference on Control and Automation
- The 1st Quantum Science, Engineering and Technology Conference
- The 28th Annual International Laser Physics Workshop (LPHYS'19)
- The 3rd South China Sea Conference
- The 5th International Workshop on Novel Magnetic and Multifunctional Materials
- The 7th International IEEE Conference on Microwaves, Communications, Antennas and Electronic Systems (IEEE COMCAS 2019)
- The 7th International Workshop on Nanotechnology and Application (IWNAN 2019)
- The Effects of Noise on Aquatic Life
- The International Workshop on 2D Crystals and Photonics
- The Singapore AUV Challenge 2019
- The Sixth International Symposium on Integrated Uncertainty in Knowledge Modelling and Decision Making
- The Women in Robotics Workshop at the R:SS Conference
- Underwater Acoustic Measurements Technologies and Results Conference and Exhibition - UACE2019
- Vietnam Young Academy Maiden Conference on Nanomaterials for Healthcare
- Wiggers-Bernard Conference Initiative for Pre-clinical Modeling in Sepsis Research
- Workshop on non-Kolmogorov turbulence and associated phenomena
- Workshops on Novel Oceanographic Observation and Monitoring Systems (Chile)
- Workshop Synthetic Biology & Energetic Materials
- 11th International Workshop on Ship and Marine Hydrodynamics
- 14th International Aluminum Conference (INALCO2019)
- 14th International Conference on Theoretical and Computational Acoustics (ICTCA 2019)
- 2019 IEEE Congress on Evolutionary Computation
- 2019 IEEE Specialist Meeting on Reflectometry using GNSS and other Signals of Opportunity
- 22nd Annual International Seminar - New Trends in Research of Energetic Materials
- 22nd International Conference on Composite Materials (ICCM22)
- 27th European Signal Processing Conference (EUSIPCO 2019)
- 34th International Workshop on Water Waves and Floating Bodies
- 3rd International Conference on CRISPR Technologies
- 3rd Latin American Symposium on Water Waves (Colombia)
- 3rd LAMLA Workshop - Listening for Aquatic Mammals in Latin America (Peru)
- 4th IEEE Southern Power Electronics Conference

INTERNATIONAL SCIENCE TOOL: RESEARCH GRANTS

Research Grant Funding Criteria: ONR Global only funds Principal Investigators (PIs) outside of the U.S. Submissions are through GRANTS.GOV based on the ONR Headquarters Long Range Broad Agency Announcement (BAA). Government Organizations are not funded. Publishing in the open literature (research unclassified) is encouraged while the intellectual property remains with the PI. Deliverable is a final report and/or conference proceeding.

Research Grant Review Criteria: Grant is fundamental research verses product development, outreach, or education along with having technical quality and qualified PIs. Requires having Naval relevance potential, a documented research approach, and cost realism.

For FY19, ONR Global had 74 new research grants across 31 countries and 60 institutions-universities covering 20 main technology areas. See the following for portfolio information:

TECH DOMAINS

- Acoustics and Undersea Technologies
- Additive Manufacturing
- AI, Machine Learning, Human-Machine, Robotics, Autonomy & Swarm
- Autonomy
- Arctic, Antarctic
- Command, Control, & Communications (C3)
- Computer Science
- Cyber
- Data Science
- Directed Energy
- Environmental Science
- Information Science
- Marine Science & Oceanography
- Material Science including, Structural, Nano & Metamaterials
- Microelectronics
- Operational Energy
- Optics & Sensors
- Physics including Statistical and Plasma
- Synthetic Biology
- Quantum Science & Technologies

COUNTRIES

Argentina	Netherlands
Australia	New Zealand
Bangladesh	Norway
Belgium	Peru
Brazil	Poland
Chile	Republic of Korea
Czech Republic	Saudi Arabia
Germany	Serbia
Greece	Singapore
Hungary	Slovenia
India	Spain
Israel	Switzerland
Italy	Taiwan
Japan	Thailand
Luxembourg	United Kingdom
Mexico	

CO-FUNDING SOURCES

ONR HQ
Air Force
Army



Research Grants

PARTNERS

- Anyeshan Limited
- Bar-Ilan University
- Ben-Gurion University of the Negev
- Centro de Investigación Científica de Yucatán, A.C
- Centro De Investigacion En Matematicas, A.C
- Cims Holding Company Limited
- Consiglio Nazionale Delle Ricerche - CNR
- Consiglio Nazionale Delle Ricerche (National Research Council, Rome)
- Ctre Nat de La Recherche Scientifiq
- Curtin University
- Curtin University of Technology
- Deimos Space UK
- Eberhard Karls University of Tübingen
- Ecole Polytechnique Fédérale de Lausanne
- Eidgenössische Technische Hochschule, ETH Zurich
- ELCRIS
- Foundation for Research and Technology Hellas (FORTH)
- Fraunhofer IAF
- Fundação de Apoio a Universidade Do
- Fundação de Desenvolvimento da Unicamp Funcamp
- IMDEA Nanociencia
- Indian Institute of Science
- Instituto de Conservacion de Ballenas
- Japan Advanced Institute of Science and Technology
- JFE Mineral Company, LTD.
- KAIST (Korea Advanced Institute of Science and Technology)
- King Abdullah University of Science and Technology
- Monash University
- Nanyang Technological University
- National Centre for Biological Sciences
- National Sun Yat-sen University

74

Research Grants

31

Countries

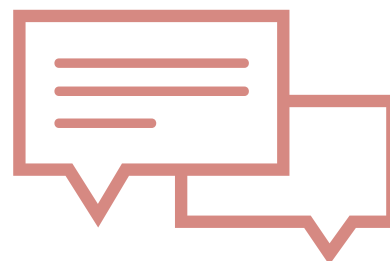
- National Taiwan Ocean University
- National Tsing Hua University
- National University of Singapore
- Netherlands Organization for Applied Scientific Research TNO
- Oxford University
- Pazmany Peter Katolikus Egyetem
- Pontificia Universidad Catolica Del
- Queensland University of Technology
- Singapore University of Technology and Design
- Soongsil University Industry-Academic Cooperation Foundation
- Stiftelsen Nansen Senter for Miljø og fjernmåling
- Technical University of Liberec
- Technische Universität Braunschweig
- The University of Auckland
- Thoughtlight Genetics
- Universidad Austral de Chile
- Universidad de Murcia
- Universidad de Zaragoza
- Universite Libre De Bruxelles
- University College London (UCL)
- University of Cambridge
- University of Glasgow
- University of Luxembourg
- University of New South Wales
- University of Sussex
- University of Tasmania
- University of Technology Sydney
- University of Warsaw
- Univerza V Maribou



HIGHLIGHTS OF OUTCOMES AND RESULTS

Small early investments in fundamental research can lead to significant and follow on results. For FY19, outcomes include:

- ★ Knowledge Transfers
- ★ TRL Progressions
- ★ Presentations
- ★ Publications
- ★ Transitions
- ★ Patents



PREVIEW OF RESEARCH GRANTS

- A Logic for Information Security
- A System-Based Approach For Ship Capsizing Prediction In Irregular Waves Causal Feature Learning
- Advanced Terahertz Communication Systems based on Uni-Traveling-Carrier Photodiode Transmitters and Plasmonic
- Airplane-Borne High Performance Coherent Doppler Lidar (CDL) To Detect Wake Turbulence
- Assessing Performance and Effects of New Integrated Implantable Large Whale Satellite Tags
- Context-Aware Intent Prediction
- Deciphering The Workings Of Molecule Intercalated Iron Chalcogenides
- Development of Algorithm to Detect Coastal Changes and Fishery Activities on the South China Sea
- Development of Computational Methodologies to Study Marine Fouling Mechanism
- Developmental Cognitive Robot With Life-Long Learning
- Development Of Large-Sized Organic Radical Battery (Orb)
- Discovering Periodic Human Behavior From Multivariate Sensor Data
- Molecular Mechanisms Of Barnacle Adhesion: A Combined Structural Biology And Computational Study
- Multi Optrode Array For Neural Interfacing
- Neurobiology Of Decision Making
- Penta-Graphene Material Properties
- Pure Two-Qubit States Carried by Single-Photons: Unrestricted Generation and Entanglement Diagnosis by Single Qubit Tomography
- Quantum Sensing Technologies Based On Multiboson Interferometry
- Ship Type Identification From Learned Satellite Image Databases
- Sonar Image Enhancement For Fly-By Mission
- Synergetic Electron Transfer From Dual Species Biofilm In Anaerobic Conductive Sediment
- Vision Enhancement Using Eye-Tracked Augmented Reality
- Zero-Power Sensing for Underwater Monitoring

ADDENDUM



INTERNATIONAL SCIENCE
PROSPECTUS
FY 2019

VSP

ARGENTINA

- **Platform Design & Survivability:** Tunable Raman Gain in Mid-IR Waveguides Instituto (*Tecnologico de Buenos Aires*)

AUSTRALIA

- **Assure Access to the Maritime Battlespace:** Current Challenges in Coastal Sediment Transport (*The University of Queensland*)
- **Electromagnetic Maneuver Warfare:** Photonic Chip-Based Microwave Signal Processing Exploiting Brillouin Scattering (*The University of Sydney*)
- **Warfighter Performance:** Biomechanics and Bio-Inspired Solutions for Flight in Complex Environments (*RMIT University*)

AUSTRIA

- **Warfighter Supremacy:** Scientific Exchange Visit Between NAMRU and AMST (*AMST - Systemtechnik GmbH*)

BRAZIL

- **Information Dominance - Cyber:** Multidimensional Coherent Spectroscopy: Revealing the Hidden Properties of Colloidal Quantum Dots (*Universidade Estadual de Campinas*)
- **Information Dominance - Cyber:** Gold Nanorod Synthesis (Metamaterials) (*Federal University of Pernambuco, Pontificia Universidade Católica do Rio de Janeiro & Rural Federal University of Rio de Janeiro*)

CANADA

- **Autonomy & Unmanned Systems:** Cell-Free Synthetic Biology Sense and Sense Making with Bioproduction (*University of Toronto*)
- **Ocean Battlespace and Expeditionary Access:** SCALES Keynote Address: The Case for One Atmosphere Diving (*Nutco Research Ltd.*)
- **Synthetic Biology:** DOD Gut Microbiome Meeting: "ARO-ONR MURI engagement: Innovations in Academia (*McMaster University*)

CHILE

- **Autonomy & Unmanned Systems:** ONR Cognitive and Human Machine Teaming Program Review (*Universidad de Chile*)
- **Autonomy & Unmanned Systems:** ONR Bio-Inspired Autonomous Systems Program Review (*Universidad de Chile*)

FRANCE

- **Power and Energy:** Keynote Address at US-European ELI Dialogue (*Ecole Polytechnique*)



VSP

GERMANY

- **Assure Access to the Maritime Battlespace:** Laser Beam Propagation in Non-Kolmogorov and Oceanic Turbulence (*Fraunhofer Institute*)
- **Information Dominance - Cyber:** ONR Distinguished Lecturer (*University of Sussex*)

INDONESIA

- **Assure Access to the Maritime Battlespace:** Progress and Challenges of Ocean Science in Indonesia for Sustainable Development in the Western Pacific Region (*Indonesian Institute of Sciences*)

IRELAND

- **Synthetic Biology:** DOD Gut Microbiome Meeting: "ARO-ONR MURI engagement: Innovations in Academia (*University College Cork*)
- **Warfighter Performance:** Performance Enhancement of Warfighters by Exogenous Ketone Supplementation (*Dublin City University*)
- **Assure Access to the Maritime Battlespace:** Coastal Sea Level Monitoring Using Satellite Radar Altimetry (*Consiglio Nazionale delle Ricerche (CNR)*)

ITALY

- **Autonomy & Unmanned Systems:** Machine Vision/ Machine Learning Project (*University of Udine*)
- **Electromagnetic Maneuver Warfare:** Machine Learning for Quantum Information Processing (*Sapienza Università di Roma*)

JAPAN

- **Assure Access to the Maritime Battlespace:** ONR Acoustic Transducer Materials and Devices Program Review (*Toyama Prefectural University*)
- **Collaboration on Visual Deficit Simulation and Augmentation:** Virtually Co-located Augmented Reality Spaces For Visualization, Training, and Navigation (*Osaka University*)
- **Warfighter Performance:** ONR Program Review (*Osaka University*)

LATVIA

- **Synthetic Biology:** Experiments at Argonne National Lab to Discern Structural Changes on Heating (*Riga Technical University*)

LUXEMBOURG

- **Expeditionary & Irregular Warfare:** LAB'RINTH: Liquid Crystal-Bead Reflectors Illuminating the Needle in the Haystack (*University of Luxembourg*)

VSP

MEXICO

- **Quantum Science: Spatial and Spectral Control of Photon Pair Sources**
(*Universidad Nacional Autonoma de Mexico*)
- **Scientific Collaboration for a Project on Unmanned Aerial Systems**
(*Autonomous University of Nuevo Leon*)

NETHERLANDS

- **Platform Design & Survivability: Visualizing Inside Dense Suspensions Under Impact Forces** (*Wageningen University*)

NEW ZEALAND

- **Ocean Battlespace and Expeditionary Access: SCALES Atmospheric Diving Suit Workshop** (*University of Auckland*)

SERBIA

- **Power Projection & Integrated Defense: Synthesis, Multi-scale Processing and Characterization of Novel Mmaterial Composites** (*Vinča Institute for Nuclear Sciences*)

SINGAPORE

- **Platform Design & Survivability: Biofouling and Coatings Program Review** (*Nanyang Technological University (NTU)*)

SPAIN

- **Warfighter Performance: MURI Annual Review Meeting Skin Microbiome Engineering** (*Pompeu Fabra University*)

SWEDEN

- **Information Dominance - Cyber: Blue/Green FSO Link for Underwater Communication Application** (*Research Institute of Sweden (RISE)*)

UNITED KINGDOM

- **Assure Access to the Maritime Battlespace: Propagation of OAM Beams in Turbulent / Turbid Natural Waters** (*University of Glasgow & University of Strathclyde*)
- **Autonomy & Unmanned Systems: 5th MAUGT - Military Applications of Underwater Glider Technology Workshop & High Latitude Collaborative Research Meeting** (*University of St Andrews*)
- **Quantum Technologies: Generalized Multi-Photon Interference with Applications to Quantum Information and Sensing** (*University of Portsmouth*)

VIETNAM

- **Assure Access to the Maritime Battlespace: Assessing the occurrence and Toxicity of Xenobiotics (PCBs/PAHs) Spiked to Microplastics in Aquatic Environment** (*Vietnam National University of HCMC*)
- **Assure Access to the Maritime Battlespace: Dynamical Characteristics of Damrey Storm and the Impact on Marine Environment and Coral Reefs** (*Institute of Oceanography*)

CSP

AUSTRALIA

- The 1st Quantum Science, Engineering and Technology Conference (*University Of New South Wales*)
- The Effects of Noise on Aquatic Life (*Curtin University of Technology*)
- 34th International Workshop on Water Waves and Floating Bodies (*The University Of Newcastle*)
- International Conference on Nonlinear, Quantum & Nanophotonics (*The Australian National University*)
- 22nd International Conference on Composite Materials (ICCM22) (*Royal Melbourne Institute Of Technology*)
- Hobart Isolated Power System (IPS) Connect 2019 (*University of Tasmania*)

AUSTRIA

- Wiggers-Bernard Conference Initiative for Pre-Clinical Modeling in Sepsis Research (*Ludwig Boltzmann Gesellschaft - Österreichische Vereinigung*)

CANADA

- IQOE Workshop on Ocean Sound Monitoring Standards (*JASCO Applied Sciences (Canada) Ltd.*)

CHILE

- Pan American Research in Additive Global Manufacturing (PARADIGMA 2019) *Pontifica Universidad Catolica de Chile*
- Workshops on Novel Oceanographic Observation and Monitoring Systems (*Universidad de Valparaíso*)

COLOMBIA

- 3rd Latin American Symposium on Water Waves (*Universidad Nacional de Colombia*)

CZECH REPUBLIC

- 22nd Annual International Seminar - New Trends in Research of Energetic Materials (*Univerzita Pardubice*)

FRANCE

- The Women in Robotics Workshop at the RSS conference (*INRIA*)

GEORGIA

- The International Workshop on 2D Crystals and Photonics (*Ivane Javakhishvili Tbilisi State University*)

CSP

GERMANY

- Electric Field Enhanced Processing of Advanced Materials
(Forschungszentrum Jülich)
- MEMRISYS 2019 - Third International Symposium on Memristive Systems (Technische Universität Dresden)
- Workshop on Non-Kolmogorov Turbulence and Associated Phenomena (Fraunhofer Institute IOSB)
- 3rd International Conference on CRISPR Technologies (Helmholtz Institute for RNA Based Research)
- 11th International Workshop on Ship and Marine Hydrodynamics (Hamburg University of Technology and BluePower Germany GmbH)

GREECE

- Underwater Acoustic Measurements Technologies and Results Conference and Exhibition - UACE2019 (FORTH)

INDIA

- International Workshop on Propulsion, Sustainable Energy and Environment (Indian Institute of Technology, Kanpur)
- India-USA Lecture Series On Aging Aircraft (Indian Institute of Science)

ISRAEL

- The 7th International IEEE Conference on Microwaves, Communications, Antennas and Electronic Systems (IEEE COMCAS 2019) (Ortra Ltd.)

ITALY

- 2019 IEEE Specialist Meeting on Reflectometry using GNSS and Other Signals of Opportunity (ATHENA SRL)
- Quantum Devices For Non-Classical Light Generation And Manipulation (Università Degli Studi di Camerino)
- New Trends in Nonequilibrium Stochastic Multistable Systems and Memristors (NES2019) (Università degli Studi di Palermo)
- Metamaterials 2019 – The Thirteenth International Congress on Artificial Materials for Novel Wave Phenomena (Università degli Studi Roma Tre)

JAPAN

- The Sixth International Symposium on Integrated Uncertainty in Knowledge Modelling and Decision Making (Japan Advanced Institute Of Science And Technology)
- 14th International Aluminum Conference (INALCO2019) (Japan Light Metal Welding Association)

MALAYSIA

- The 3rd South China Sea Conference (University of Malaya)

CSP

MEXICO

- Nanostructured Plasmonic Materials; and Emerging 2D Materials and 2D Heterostructures: Synthesis, Characterization and Collective Phenomena, on XXVIII International Materials Research Congress - IMRC 2019: Symposia A1 and B1 (*Instituto de Física*)

NETHERLANDS

- Workshop Synthetic Biology & Energetic Materials (*Nederlandse Organisatie Voor Toegepast-Natuurwetenschappelijj*)

NEW ZEALAND

- 2019 IEEE Congress on Evolutionary Computation (*Victoria University of Wellington*)

PERU

- 3rd LAMLA Workshop - Listening for Aquatic Mammals in Latin America

REPUBLIC OF KOREA

- The 28th Annual International Laser Physics Workshop (LPHYS'19) (*Pohang University of Science and Technology*)
- International Symposium on Frontiers of Translation Materials Science (*Industry University Cooperation Foundation - Hanyang University*)
- The 12th IFAC Conference on Control Applications in Marine Systems, Robotics, and Vehicles (CAMS2019) (*Korea Advanced Institute of Science and Technology*)

SAUDI ARABIA

- IEEE Wireless Communications and Networking Conference (WCNC 2019)

SINGAPORE

- 4th IEEE Southern Power Electronics Conference (*Nanyang Technological University*)
- Future Trends in Synthetic Biology Asia (*National University of Singapore*)
- Global Space and Technology Convention (GSTC) 2019 - Technical Sessions (*Singapore Space And Technology Association*)
- The Singapore AUV Challenge 2019 (*National University Of Singapore*)
- The 15th IEEE International Conference on Control and Automation (*Institute of Electrical & Electronics Engineers (USA)*)
- International Conference on Genomes and AI: From Packing to Regulation (*National University Of Singapore*)

CSP

SPAIN

- 27th European Signal Processing Conference (EUSIPCO 2019)
(Fundación Universidade Da Coruña)

SWITZERLAND

- Bioinspired Materials: From Understanding, Through Processing, To Replication (*Ecole Polytechnique Federale de Lausanne*)
- International Symposium on Piezocrystals and their Applications (*Ecole Polytechnique Fédérale de Lausanne*)
- Security and Resilience for Emerging Synthetic Biology and Biotechnology Threats (*Ecole Polytechnique Federale de Lausanne*)

TAIWAN

- 14th International Conference on Theoretical and Computational Acoustics (ICTCA 2019) (*National Taiwan University*)
- The 15th Annual International Conference on Intelligent Unmanned Systems (ICIUS 2019) (*International Society of Mechatronic Engineering*)

THAILAND

- ASGC5 - 5th ASEAN Smart Grid Congress (*Naresuan University, School of Renewable Energy and Smart Grid Technology (SGtech)*)

UNITED KINGDOM

- Reliable Neuromorphic Perception and Control for Robotics (RNP-C-R) Workshop (*The University of Edinburgh*)
- Computational Approaches For Long Range Imaging And Sensing In Scattering Media (*University of Glasgow, Glasgow G12 8QQ, UK*)
- Designer Biology Symposium (*Newcastle University*)
- MarineComm: Workshop on Communication Technology Transfer for Ocean Science (*University of Glasgow*)

VIETNAM

- The 5th International Workshop on Novel Magnetic and Multifunctional Materials (*Institute of Materials Science*)
- Vietnam Young Academy Maiden Conference on Nanomaterials for Healthcare (*VNU-HCM University of Science*)
- The 7th International Workshop on Nanotechnology and Application (IWNA 2019) (*Institute for Nanotechnology*)



RESEARCH GRANTS

FISCAL YEAR 2016 GRANTS

CHILE

- Impact of Preferred Eddy Tracks on Tracers in Eastern Boundary Upwelling Systems (*Universidad de Concepcion*)
- Soft Modular Robotic Cubes: Replicating the Morphogenetic Movements of the Embryo (*Universidad de Chile*)

UNITED KINGDOM

- Trust and Communication in Military Operations and Civilian Emergencies (*Heriot-Watt University, United Kingdom*)

FISCAL YEAR 2017 GRANTS

CHILE

- Voice Based Human-Robot Social Integration (*Universidad de Chile*)
- Social Complexity and Critical States of Society (*Juan Pablo Cardenas Servicios Informaticos Investigaciones*)
- Climate Projections of Tropical Cyclone Activity Over the Caribbean and East Pacific Regions from an Ensemble of Regional Climate (*Universidad de Valparaiso*)

FRANCE

- Automatic Global Monitoring of the Earth from Space: A Big Leap in Satellite Imaging

JAPAN

- Causal Feature Learning (*Shiga University*)

ISRAEL

- Predictive CFD Modeling and Experimental Studies of Basic Processes in Static and Flowing-Gas K DPALs (*Ben-Gurion University of the Negev*)

REPUBLIC OF KOREA

- Millimeter Wave Adaptive Power Beaming of UAVs (*Soongsil University Industry-Academy, Republic of Korea*)

SPAIN

- Experimental Study of Propeller-Appendage-Hull Interactions of Underwater Vehicles in Steady Drift (*Consiglio Nazionale Delle Ricerche Istituto Nazionale*)

FISCAL YEAR 2018 GRANTS

ARGENTINA

- Search for Vulnerabilities of Fundamental Origin in Quantum Key Distribution (*Fundacion Ciencias Exactas y Naturales, Argentina*)

AUSTRALIA

- A Logic for Information Security (*University Of Melbourne, Australia*)
- Context-Aware Intent Prediction (*University of New South Wales, Australia*)
- Distributed Symbolic-Non-Symbolic Context-Aware Swarm Logics (*University of New South Wales, Australia*)
- Optimization of Carbon Fiber Surfaces for Advanced Composites (*Deakin University, Australia*)
- Exploration and Design of High Performance Relaxor Ferroelectrics Based on Microstructure Study (*University of Wollongong, Australia*)
- Gallium Nitride for Quantum Applications (*University of Technology Sydney, Australia*)
- Multi-Optrode Array for Neural Interfacing (*University of New South Wales, Australia*)
- Neurobiology of Decision Making (*Monash University, Australia*)
- Optimization of Carbon Fiber Surfaces for Advanced Composites (*Deakin University, Australia*)
- Trans-Jacket Fibre Bragg Gratings for In-Situ Health Monitoring of Defense Platforms in Harsh Environments (*Monash University, Australia*)
- Understanding the Complex Microstructure of Additively Manufactured Alloys (AMAs) and Its Relationship to Durability (*Monash University, Australia*)

RESEARCH GRANTS

FISCAL YEAR 2018 GRANTS

BRAZIL

- Ion Beam Assisted Deposition Of Gallium Oxide Based Films for High Power Device Applications (*Universidade de Sao Paulo, Brazil*)

CANADA

- How the Brain Builds Visual Object Detectors (*Royal Institution for the Advancement of Learning (McGill University, Canada)*)

CHILE

- Fish SONAR: Stochastic Variability of Fish School Scattering (*Pontificia Universidad Catolica de Chile*)
- Solution-Processed Metal Oxide Thin Films for Quantum Dot-Based Photonic Devices (*Pontificia Universidad Catolica de Valparaiso, Chile*)
- Study of the Non-Equilibrium Magnetic Properties of Individual Molecules for Quantum Information (*Pontificia Universidad Catolica de Chile, Chile*)
- Whales in Estuaries: Glider Surveys and Fixed Time Series for Explaining Distribution (*Universidad de Concepcion, Chile*)

DENMARK

- Gene Expression In Multispecies Biofilms – Linking Structure and Function (*University of Copenhagen, Denmark*)

FRANCE

- Automatic Global Monitoring of the Earth From Space: a Big Leap in Satellite Imaging (*France*)
- Strongly Typed Numerical Computation (Tycoon) (*Universite de Perpignan via Domitia, France*)
- Understanding & Modeling Stress-Diffusion Coupling Effects in Carbon Fiber Reinforced Marine Composites (*Inst Fr Recherche Pour L Exploit Mer, France*)

GERMANY

- Basic Icebreaking Study (*Hamburgische Schiffbau-Versuchsanstalt GmbH, Germany*)
- Experimental Analysis of Coherent Vertical Structures Behind Fixed and Moving Blunt Bodies (*Technischen Universitaet Hamburg-Harburg, Germany*)
- Influence of Spatial and Temporal Variations in Ice Loading on the Design of Ship Structures (*Technischen Universtitaet Hamburg-Harburg, Germany*)

GREECE

- Multi-Dimensional Signal Design For Wideband HF Links (*Institute of Accelerating Systems and Applications, Greece*)

INDIA

- Shock Wave Propagation Physics Through a Medium (*Indian Institute of Technology Kharagpur (Nilanjan Mitra), India*)
- Thermoacoustic Instability as Pattern Formation in a System Far from Equilibrium (*Indian Institute of Technology Madras, India*)

ISRAEL

- Electric-Field Control of Gene Expression in On-Chip DNA Compartments (*Weizmann Institute of Science, Israel*)
- Predictive CFD Modeling and Experimental Studies of Basic Processes in Static and Flowing-Gas K DPALs (*Ben-Gurion University of the Negev, Israel*)
- Studies Related to Cold Atoms Frequency Standards (*Ben-Gurion University of the Negev, Israel*)
- Study of Advanced Methods for Characterization of Multilayer Semiconductors (*Ben-Gurion University of the Negev, Israel*)

ITALY

- Effects of Superhydrophobic Surfaces on Turbulent Boundary Layer Induced Vibration and Drag (*Istituto Nazionale, Italy*)
- Analytical and Numerical Methods for Identifying Principal Components of Heterogeneous Physical Data (*Consiglio Nazionale delle Ricerche Istituto INSEAN, Italy*)
- Non-Collaborative Object Tracking (nCOT) (*University of Ferrara, Italy*)
- Collective Decisions In Dynamic Environments (*Consiglio Nazionale Delle Ricerche, Italy*)

RESEARCH GRANTS

FISCAL YEAR 2018 GRANTS

JAPAN

- Data Analytics for Electromagnetic Signals of Opportunities in Ambient of Objects Over Heterogeneous Surface (*Osaka Institute of Technology, Japan*)
- Development of Re (Al,Si) 1.8 Coating Systems on Nb-Hf Alloys and Its Oxidation Property at High Temperatures (*DBC System R&D CO.,LTD., Japan*)
- Vision Enhancement Using Eye-Tracked Augmented Reality (*Osaka University, Japan*)

LUXEMBOURG

- HUNTED - Heterogeneous Multi-Swarms of Unmanned Autonomous Systems for Mission Deployment (*Universite Du Luxembourg, Luxembourg*)
- Liquid Crystal-Bead Reflectors Illuminating the Needle in the Haystack (LAB'RINTH) (*University of Luxembourg, Luxembourg*)

MALAYSIA

- Developmental Cognitive Robot with Life-long Learning (*University of Malaya, Malaysia*)
- Standalone Maximum Power Point Tracking Controller for Partially Shaded Photovoltaic Array under Fast Varying Solar Intensity (*University of Malaya, Malaysia*)

REPUBLIC OF KOREA

- Heat Transfer Studies of a Pulsating Heat Pipe Using High Speed Infrared Thermometry (*Korea Advanced Institute of Science and Technology, Republic of Korea*)
- New AC Poling Technique for Maximizing Dielectric and Piezoelectric Properties of Donor/Acceptor-Modified PMN-PZT (*Ceracomp Co., Ltd., Republic of Korea*)

SERBIA

- Aggregating Computational Algorithms and Human Decision-Making Preferences in Multi-Agent Settings (*Univerzitet U Beogradu-Fakultet Organizacionih Nauka, Serbia*)

SINGAPORE

- Planning Under Uncertainty with Factored Actions (*National University of Singapore, Singapore*)

SPAIN

- Development of Hybrid Graphene-Superconductor Detectors for Quantum and Space (*Fundacion Imdea Nanociencia, Spain*)
- Experimental Study of Propeller-Appendage-Hull Interactions of Underwater Vehicles in Steady Drift (*Consiglio Nazionale Delle Ricerche Istituto Nazionale, Spain*)
- Re-Configurable Biocomputing Circuits (rCBC) (*Universitat Pompeu Fabra, Spain*)

SWEDEN

- Stress-Adaptive Training Design For Accelerated Learning and Improved performance In High-Stress Situations, Y2&3 (*Geistt AB, Sweden*)

SWITZERLAND

- Contribution of Polar Nano-Regions to the Large Piezoelectric Response in Pb-Based Relaxor Ferroelectrics (*Ecole Polytechnique Federale de Lausanne, Switzerland*)

TAIWAN

- Correlation Spectra in Nonlinear Modulation Instabilities and Rogue Waves (*National Tsing Hua University, Taiwan*)
- Development of Superhydrophobic and Superhydrophilic Interfaces on Elastomer for Marine Fouling Resistance (*National Central University, Taiwan*)

RESEARCH GRANTS

FISCAL YEAR 2018 GRANTS

UNITED KINGDOM

- Active Sensing in Echolocating Marine Mammals (*United Kingdom*)
- Affordable, Sustainable, Secure and Distributed Biomanufacture in Halomonas with Optogenetic Control (HALOPT) (*University of Manchester, United Kingdom*)
- Anticipating Decisions and Bell's Bound (*The City University - London, United Kingdom*)
- Assessing Performance and Effects of New Integrated Implantable Large Whale Satellite Tags (*United States*)
- Bacterial Flagellar Motor as Fast Synthetic Biosensor (*University of Edinburgh, United Kingdom*)
- BRAIN-inspired Networks of Ultrafast LASER Neurons (*University of Strathclyde, United Kingdom*)
- Compact High-Power Microwave Oscillators (*University of Strathclyde, United Kingdom*)
- Coordinated Swarm Behavior with Minimal Communication in Complex Topographies (*University College London, United Kingdom*)
- Data Integrated Models of Unsteady Ship Hydrodynamic Forces (*University Of Southampton, United Kingdom*)
- Improving the t-SNE Data Visualization Algorithm via Stochastic Sampling (*University of Glasgow, United Kingdom*)
- Learning an Effective Representation for the Hidden Semantics (*Hanoi University of Science and Technology, Vietnam*)
- Living Materials: Beyond Self-Healing (*Imperial College of London, United Kingdom*)
- Nanostructured Metamaterials for High-Tc Superconductivity (*University of Cambridge, United Kingdom*)
- Optical Magnetic Field Sensor (*United Kingdom*)
- Provenance Analytics for Command and Control (PA4C2) (*King's College London, United Kingdom*)
- Quantum Sensing Technologies Based on Multiboson Interferometry (*University of Portsmouth, United Kingdom*)
- Trust And Communication In Military Operations And Civilian Emergencies (*Heriot-Watt University, United Kingdom*)

FISCAL YEAR 2019 GRANTS

ARGENTINA

- Assessing Performance and Effects of New Integrated Implantable Large Whale Satellite Tags (*Instituto de Conservacion de Ballenas*)

AUSTRALIA

- Advanced in Situ X-ray and Neutron Scattering to Reveal Structural and Microstructural Response Mechanisms of Modern Single Crystal Electro-Mechanical Materials (*University of New South Wales, Australia*)
- Characterization of Long Lengths of Commercial High Temperature Superconducting (HTS) Tape and Wire (*Queensland University of Technology, Australia*)
- Context-Aware Intent Prediction (*University of New South Wales, Australia*)
- Covert State Discovery and Multi-Agent Reinforcement Learning for Human-Autonomy Teaming (*University of Technology Sydney, Australia*)
- Detect, Explore and Neutralize NEW Threats Using Advanced Machine Learning (*University of Technology Sydney*)
- Efficient Parameter Identification and Robust Control of Quantum Systems (*University of New South Wales, Australia*)
- Feasibility and Accuracy of Multi-Component Models of Ocean Ambient Noise to Predict Noise Spectra on a Short-time Scale and Assess Long-term Trends in Noise Components (*Curtin University of Technology, Australia*)
- Nucleation and Cavitation Inception in Tip Leakage Flows (*University Of Tasmania, Australia*)
- Structural Integrity of Composite and Adhesively Bonded Aircraft Structures from the Perspective of Multiaxial Cyclic Loading (*Monash University, Australia*)
- Tuning Peripheral Vision for Perception in Panoramic Imagery (*Curtin University, Australia*)
- Towards clinical trial of HARPER* for Internal Fixation (*Healing Assessment Routine Protocol for Early Return to Service) (*Monash University, Australia*)

RESEARCH GRANTS

FISCAL YEAR 2019 GRANTS

BANGLADESH

- Non-Invasive Measurement of Sea Ice Thickness Using Low Frequency EM Waves (*Anyeshan Limited, Bangladesh*)

BELGIUM

- Mergeable Nervous Systems for Robotic Swarms (*Universite Libre de Bruxelles, Belgium*)

BRAZIL

- Cavitation Erosion and Unsteadiness (*Ctre Nat de La Recherche Scientifiq, Brazil*)
- LOAD Project: Long Term Analysis of Suspended Particulate Matter Concentrations Affecting Port Areas in Developing Countries (*Fundacao de Apoio a Universidade Do, Brazil*)
- Low-Dimensional Superconductivity for Sensors of Electromagnetic Fields (*Fundação de Desenvolvimento da Unicamp Funcamp, Brazil*)

CHILE

- Assessing Performance and Effects of New Integrated Implantable Large Whale Satellite Tags (*Universidad Austral de Chile*)

CZECH REPUBLIC

- Advanced Methods for Blind Extraction of Independent Sources from Multi-Sensor Observations (*Technical University of Liberec, Czech Republic*)
- Health and Activity Monitoring by Wearables in Extreme Conditions (*Vysoke Ucení Technické v Brně, Czech Republic*)

GERMANY

- AlGaIn/GaN HEMT Devices on 200 mm Engineered Substrates for 5G Applications (*Fraunhofer IAF, Germany*)
- Fundamentals of Canode Biofilm Electro-Metabolism (*Technische Universität Braunschweig, Germany*)
- Genetic Determinants for Formate Metabolism in Methanothermobacter Thermotrophicus (*Eberhard Karls University of Tübingen, Germany*)

GREECE

- Source Sensitivity Kernels: A New Tool for Noise Cross-Correlation Studies (SSK) (*Foundation for Research and Technology Hellas (FORTH), Greece*)

HUNGARY

- Probabilistic Processing of Sequential Auditory Information in Noise (*Pazmany Peter Katolikus Egyetem, Hungary*)

INDIA

- Bio Inspired Blast Resistant Marine Sandwich Structures (*Indian Institute of Science, India*)
- Understanding Community Composition of Marine Mammals in the Northern Indian Ocean Using Visual and Passive Acoustic Methods (*National Centre for Biological Science, India*)

ISRAEL

- Advances in Temporal Data Mining for Clustering, Classification, and Prediction Purposes: Integrating Domain Knowledge within Temporal Learning (*Ben Gurion University of the Negev, Israel*)
- Anomaly Detection and Machine Learning Using Graph Patterns (*Bar-Ilan University, Israel*)
- Sensitivity Enhancement of Pulsed Atomic Magnetometer for Minute Changes in Ambient Magnetic Field (*Ben-Gurion University of the Negev, Israel*)

ITALY

- Affordance Landscape Viewer (ALV): Learning New Skills by Visualization Object Affordances That Only Experts Can See (*Consiglio Nazionale Delle Ricerche, Italy*)
- Intermittent Contact Local Dielectric Spectroscopy (*Consiglio Nazionale Delle Ricerche, Italy*)

RESEARCH GRANTS

FISCAL YEAR 2019 GRANTS

JAPAN

- Improvement of Thermal Stability of PIN-PMN-PT Single Crystal (*JFE Mineral Company, Ltd., Japan*)
- Multi-Source Learning Coupled with Reasoning Capabilities for Large-Scale Decision Support Environments (*Japan Advanced Institute of Science and Technology, Japan*)

LUXEMBOURG

- Liquid Crystal-Bead Reflectors Illuminating the Needle in the Haystack (LAB'RINTH) (*University of Luxembourg, Luxembourg*)

MEXICO

- Noncommutative Adaptive Estimation for Dimension Reduction and Data Clustering (*Centro De Investigacion en Matematicas, A.C., Mexico*)
- Integrated Thermo-Mechanical Monitoring of Composites Using Carbon Nanotube Yarns (*Centro de Investigación Científica de Yucatán, A.C., Mexico*)

NETHERLANDS

- Turbulence Improvements by Combination of Dedicated Hardware and Software (*Netherlands Organization for Applied Scientific Research TNO, Netherlands*)

NEW ZEALAND

- A Fully Certified Quantum Random Generator – Theoretical Part (*Elcris, New Zealand*)
- Prediction in Evolving Data Streams Using an Adaptive System (*The University of Auckland, New Zealand*)

NORWAY

- Under-Ice and Canape: Analysis and Publication (*Stiftelsen Nansen Senter for Miljø og Fjernmåling, Norway*)

PERU

- Pure Two-Qubit States Carried by Single-Photons: Unrestricted Generation and Entanglement Diagnosis by Single-Qubit Tomography (*Pontificia Universidad Catolica Del, Peru*)

POLAND

- Super-Resolution Imaging Techniques Based on Spatial Coherence (*University of Warsaw, Poland*)

REPUBLIC OF KOREA

- Compositional Verification of Trusted Execution Environments and I/O Kernels (*Korea Advanced Institute of Science and Technology, Republic of Korea*)
- Millimeter Wave Adaptive Power Beaming of UAVs (*Soongsil University Industry-Academic Cooperation Foundation, Republic of Korea*)
- Supporting Learning & Collaboration in Online Discussion (*Korea Advanced Institute of Science and Technology, Republic of Korea*)

SAUDI ARABIA

- Exploring the Fundamental Mechanisms of Light Modulation and Amplification in Halide-Perovskite Nanostructures (*King Abdullah University of Science and Technology, Saudi Arabia*)

SERBIA

- Aggregating Computational Algorithms and Human Decision-Making Preferences in Multi-Agent Settings (*Univerzitet U Beogradu-Fakultet Organizacionih Nauka, Serbia*)

SINGAPORE

- Adaptive GHz Devices (*Singapore University of Technology and Design, Singapore*)
- An Exploratory Framework for Efficient and Secure Tactical Information Dispersal (*National University of Singapore, Singapore*)
- A Universal Hardware-In-Loop Platform for Hybrid AC/DC Microgrids (*Nanyang Technological University, Singapore*)

RESEARCH GRANTS

FISCAL YEAR 2019 GRANTS

SINGAPORE (CONT.)

- Fractional Modeling of Electromagnetic Wave Propagation in Meta-Materials (*Singapore University of Technology and Design, Singapore*)
- Transformer-Less Topologies and Control Techniques for Medium-Voltage Battery Energy Storage Systems (*Nanyang Technological University, Singapore*)

SLOVENIA

- Optical Fiber Sensors for Direct Corrosion Monitoring and Detection (*Univerza v Mariboru, Slovenia*)

SPAIN

- Development of Hybrid Graphene-Superconductor Detectors for Quantum and Space (*IMDEA Nanociencia, Spain*)
- Distributed High-Level Scene Reasoning (*Universidad de Zaragoza, Spain*)
- Plant Intelligence for Robotics and AI (*Universidad de Murcia, Spain*)

SWITZERLAND

- Zero-Power Sensing for Underwater Monitoring (*Eidgenössische Technische Hochschule, ETH Zurich, Switzerland*)
- Electrically and Optically Induced Strain in Single Crystals of Hybrid Perovskites (Methylammonium Lead Halides) (*Ecole Polytechnique Fédérale de Lausanne, Switzerland*)

TAIWAN

- Correlation Spectra in Nonlinear Modulation Instabilities and Rogue Waves (*National Tsing Hua University, Taiwan*)
- Cross-Slope Acoustic Scattering & Transmission Experiment (CASTEx) in the Northeastern South China Sea (*National Sun Yat-sen University, Taiwan*)
- Experimental Investigation on High-Reynolds-Number Flows around a 6:1 Prolate Spheroid (*National Taiwan Ocean University, Taiwan*)
- Intrusion Detection of Malicious Cyber Attacks in Isolated Three-Phase AC Microgrids under Distributed Droop Control (*National Tsing Hua University, Taiwan*)

THAILAND

- Development of Wearable Amine/Ammonia Sensors for Health Monitoring (*Cims Holding Company Limited, Thailand*)

UNITED KINGDOM

- Cryptochrome-Based Magnetic Sensors (*Oxford University, United Kingdom*)
- DNA-Enabled Bio Battery – Seeking to Address the Limitations of Portable Power Supply (*Toughtlight Genetics, United Kingdom*)
- Electromagnetic Scattering from Rough Surfaces in Three Dimensions at Low Grazing Angles (*University of Cambridge, United Kingdom*)
- Estimating Causal Treatment Effects: A Theoretical and Computational Framework for Model Evaluation, Selection and Development (*University of Cambridge, United Kingdom*)
- GPS-Reflectometry for Target Detection (*Deimos Space UK, United Kingdom*)
- Proposal for a Deterministic Solid-State Quantum Memory (*University of Cambridge, United Kingdom*)
- Radar Analysis and Prediction of Intentions/Behaviour of Small Drones' Swarms - Rapid (*University of Glasgow, United Kingdom*)
- Robust Factorial Causal Predictions with Observational and Interventional Data (*University College London (UCL), United Kingdom*)
- Transforming Additive Manufacturing via In-situ and Operando Synchrotron Imaging Exploring the Fundamental Mechanisms of Light Modulation and Amplification in Halide-Perovskite Nanostructures (*University College London, United Kingdom*)
- Voltage Controlled Quantum Logic with Trapped Ions (*University of Sussex, United Kingdom*)

VIETNAM

- Learning an Effective Representation for the Hidden Semantics (*Hanoi University of Science and Technology*)

Research Grant

OUTCOMES & RESULTS

(Sample)



A Logic for Information Security

- *Presentation:* Toby Murray, University of Melbourne. Sec CSL: Security Concurrent Separation Logic, International Conference on Computer-Aided Verification (CAV) 2019

A System-Based Approach For Ship Capsizing Prediction in Irregular Waves

- *Knowledge Transfer:* Technology presented at NRE Site Review.
- *Publication:* Htet, T.Z., Umeda, N. Maki, A. et al. J Mar Sci Technol (2019). 24:317. <https://doi.org/10.1007/s00773-017-0507-1>
- *Publication:* Htet Zaw Htet, Umeda, N., Matsuda, A. et al. J Mar Sci Technol (2019) 24:166. <https://doi.org/10.1007/s00773-018-0544-4>

Advanced Terahertz Communication Systems based on Uni-Travelling-Carrier Photodiode Transmitters and Plasmonic

- *Presentation:* Tadao Nagatsuma, Osaka University. 300-GHz-band Wireless Communication Using Fermi-level Managed Barrier Diode Receiver, 2019 IEEE MTT-S International Microwave Symposium
- *Presentation:* Tadao Nagatsuma, Osaka University. 12.5-Gbit/s Wireless Link at 720 GHz Based on Photonics, 44th International Conference on Infrared, Millimeter, and Terahertz Waves

Airplane-Borne High Performance Coherent Doppler Lidar (CDL) To Detect Wake Turbulence

- *Knowledge Transfer:* Technology presented at 30th US-Japan Technology Forum at Vanderbilt University, where NIPO and US DOD stakeholders were present.
- *TRL progression:* TRL1 (concept) to TRL3 (materials and design innovation to make large-scale prototype possible).

Amazon Shelf Break Carbonate Reefs

- *Proceeding:* 49th Brazilian Congress of Geology, Abstract, p. 521, ISBN 978-85-99198-20-9
- *Proceeding:* 1st Brazilian Symposium on Marine Geology and Geophysics, Conference

Causal Feature Learning

- *Publication:* Bloebaum, P., Janzing, D., Washio, T., Shimizu, S. & Schoelkopf, B. (2018). Cause-Effect Inference by Comparing Regression Errors. Proceedings of the Twenty-First International Conference on Artificial Intelligence and Statistics, in PMLR 84:900-909. <http://proceedings.mlr.press/v84/bloebaum18a/bloebaum18a.pdf>

Charge Transfer Plasmon Metamolecules for Infrared Optical Therapy

- *Publication:* X. Zhang, et al. "Know Your Mind: Adaptive Cognitive Activity Recognition with Reinforced CNN," 2019 IEEE International Conference on Data Mining (ICDM), Beijing, 2019. (Preprint on arXiv - <https://arxiv.org/pdf/1802.03996.pdf>)

Research Grant

OUTCOMES & RESULTS

(Sample)

Computational Tools for Floating Wind Turbines

- *Proceeding:* A Brazil-Japan collaboration on a conceptual design of a floating offshore wind turbine for the São Paulo coast, Rodolfo T. Gonçalves, Guilherme R. Franzini, Alexandre N. Simos, Alfredo G. Neto, Pedro C. de Mello, Bruno S. Carmo, Kazuo Nishimoto, Edgard B. Malta, Daniel P. Vieira, Lucas H. S. do Carmo, Giovanni A. Amaral, Marielle de Oliveira, Ryota Wada, Shinichiro Hirabayashi, Hideyuki Suzuki, International Congress on Waterborne Transportation, Shipbuilding and Offshore Constructions (SOBENA 2018), 23-25 October, 2018, Rio de Janeiro, Brazil.
- *Proceeding:* A Dynamic Nonlinear Analysis of a Wind Turbine Tower, Heloísa C. Beraldo, Guilherme R. Franzini, International Symposium on Solid Mechanics, 26-28 April 2017, Joinville, Brazil.
- *Proceeding:* A numerical assessment of stiffness associated with a single mooring line: the effect of sea current and application for a floating offshore wind turbine, Giovanni A. Amaral, Estevan C. Isaak, Alfredo G. Neto, Guilherme R. Franzini, CILAMCE - Ibero-Latin-American Congress on Computational Methods in Engineering, 11-14 November 2018, Paris/Compiègne, France.
- *Proceeding:* Bidimensional numerical simulations of the flow around arrays of four fixed cylinders, Daniela M. U. Kawaguti, Alessandro Alberto de Lima, Guilherme R. Franzini, 9th International Symposium on Fluid-Structure Interactions, Flow-Sound Interactions, Flow-Induced Vibration & Noise, 8-11 July 2018, Toronto, Canada.
- *Proceeding:* Further discussion on the white-noise approach for predicting slow drifts in FAST, Lucas H. S. do Carmo, Ewerton C. Camargo, Alexandre N. Simos, ASME 1st International Offshore wind Technical Conference (IOWTC 2018), 4-7 November, 2018, San Francisco CA, USA, December 13, 2018, DOI: 10.1115/IOWTC2018-1014.
- *Proceeding:* Mooring system stiffness: A general analytical formulation with an application to floating offshore wind turbines, Celso P. Pesce, Giovanni A. Amaral, Guilherme R. Franzini, ASME 1st International Offshore wind Technical Conference (IOWTC 2018), 4-7 November, 2018, San Francisco CA, USA, December 13, 2018, DOI: 10.1115/IOWTC2018-1040.
- *Proceeding:* On the use of the white-noise approximation for modelling the slow-drifts of a FOWT: An example using FAST, Alexandre N. Simos, Lucas H. S. do Carmo, Ewerton C. Camargo, ASME 37th International Conference on Ocean, Offshore and Arctic Engineering (OMAE2018), June 17-22, 2018, Madrid, Spain
- *Publication:* Modeling wind turbines blades by geometrically-exact beam and shell elements: A comparative approach, Jorunal: Engineering Structures, Celso J. Facciso Jr, Ana C. P. Cardozo, Valdemar Monteiro Jr, Alfredo Gay Neto, DOI 10.1016/j.engstruct.2018.09.032, 26 November 2018, Vol. 180 (1): 357.

Context-Aware Intent Prediction

- *Publication:* X. Zhang, et al. "Know Your Mind: Adaptive Cognitive Activity Recognition with Reinforced CNN," 2019 IEEE International Conference on Data Mining (ICDM), Beijing, 2019. (Preprint on arXiv - <https://arxiv.org/pdf/1802.03996.pdf>)

Deciphering The Workings Of Molecule Intercalated Iron Chalcogenides

- *Publication (submitted):* On the Nanoscale Structure of $K_xFe_{2-y}Ch_2$ (Ch= S, Se): 2 a Neutron Pair Distribution Function View” supported by NICOP grant N62909-17-1-2126



Development Of Algorithm To Detect Coastal Changes and Fishery Activities on the South China Sea

- *Publication:* Asanuma, I. , Hasegawa, D., Yamaguchi, T. , Park, J. and Mackin, K. (2018) Island Activities Detected by VIIRS and Validation with AIS. *Advances in Remote Sensing*, 7, 171-182. doi: 10.4236/ars.2018.73012.

Development of Computational Methodologies to Study Marine Fouling Mechanism

- *Publication:* Ly Le, International Univ of Ho Chi Minh City. Effects of inter-organism interactions in biofouling on microporous surfaces, *The Journal of Bioadhesion and Biofilm Research* 2019

Development of Large-Sized Organic Radical Battery (ORB)

- *Knowledge Transfer:* Technology presented to NRE, NR&DE, Fleet, and ITC-PAC stakeholders.
- *TRL progression:* TRL2 (concept and microscale prototype) to TRL4 (large demo piece ready)

Developmental Cognitive Robot With Life-Long Learning

- *Presentation:* Gin Chong Lee, Chu Kiong Loo, Naoki Masuyama. (2018). Multi-objective Particle Swarm Optimization (MOPSO) for parameters estimation in Topological Kernel Bayesian ART (TKBA). *IEEE Symposium Series on Computational Intelligence (SSCI)* 2018.
- *Publication:* Naoki Masuyama, Chu Kiong Loo, Stefan Wermter. (2019). A Kernel Bayesian Adaptive Resonance Theory with a Topological Structure. *Journal of Neural Systems*. (In press).

Discovering Periodic Human Behavior From Multivariate Sensor Data

- *Publication:* Kim, D., Lee, J., Choy, M., Kim, H., and Motoda, H., "Discovering Periodic Association Sequences from Multivariate Time Series," submitted to *ACM Trans. on Knowledge Discovery from Data* (under major revision).

Learning an Effective Representation for the Hidden Semantics

- *Publication:* Than, Hanoi University of Science and Technology. A Flexible Stochastic Method for Solving the MAP Problem in Topic Models, *Computacion y Sistemas*, 22, no. 4 (2018), Khoat

Model-Based Fuzzing for Finding Kernel Vulnerabilities

- *Presentation:* Sang Kil Cha, KAIST. Grey-box Concolic Testing on Binary Code, *International Conference on Software Engineering* 2019
- *Presentation:* Sang Kil Cha, KAIST. CodeAlchemist: Semantics-Aware Code Generation to Find Vulnerabilities in JavaScript Engines, *Network and Distributed System Security Symposium* 2019

Research Grant

OUTCOMES & RESULTS

(Sample)

Molecular Mechanisms Of Barnacle Adhesion: A Combined Structural Biology And Computational Study

- *Knowledge Transfer*: NRE Biofouling & Coating Program 18-20 June.
- *Presentation*: International Conference on Adhesion in Aqueous Media: From Biology to Synthetic Materials; Dresden, Germany 9-12 September 2019
- *Presentation*: International Conference on Materials for Advanced Technologies, Singapore 23-28 June 2019
- *Publication (Submitted)*: Bioadhesion and Biofouling in “Philosophical Transactions B” of the Royal Society

Multi Optrode Array For Neural Interfacing

- *Knowledge Transfer (University Education)*: “Towards the development of an optrode sensor: characterization of in vitro cardiac tissue recordings”, Master Thesis, EPFL (2019).
- *Knowledge Transfer (Media)*: <https://www.businessinsider.com.au/chip-brain-machine-interface-science-australia-2018-9>
- *Knowledge Transfer (Media)*: <https://www.itnews.com.au/news/us-navy-taps-unsw-to-develop-brain-machine-interface-511667>
- *Knowledge Transfer (Media)*: <https://newsroom.unsw.edu.au/news/science-tech/unsw-engineers-win-us-naval-grant-develop-brain-machine-interface>
- *Patent (submitted)*: (Provisional patent) A. Al Abed and N. H. Lovell, “Noise cancellation and signal calibration in multi-channel electrophysiology recording systems.”
- *Publication*: Xinyue Lei, Christoph Wieschendorf, Josiah Firth, Francois Ladouceur, Leonardo Silvestri, and Alex Fuerbach, “All-in-one fiber laser based on liquid crystal transducers”, IEEE Photonic Technology Letter. DOI: 10.1109/LPT.2019.2929553

Neurobiology Of Decision Making.

- *Publication*: Van Kempen J, Loughnane GM, Newman DP, Kelly SP, Thiele A, O'Connell RG, Bellgrove MA. (2019). Behavioural and neural signatures of perceptual decision-making are modulated by pupil-linked arousal. Elife. 2019 Mar 18;8. pii: e42541. doi: 10.7554/eLife.42541

Penta-Graphene Material Properties

- *Publication*: Wenzhou Chen, Ming Yang, Yi-Yang Sun, Yoshiyuki Kawazoe, Xingqiang Shi, Hui Pan, Design of pentagonal NbX monolayers for electronics and electrocatalysis, Applied Surface Science, Volume 479, 2019, Pages 595-600, ISSN 0169-4332, <https://doi.org/10.1016/j.apsusc.2019.02.110>.

Planning under Uncertainty with Factored Actions

- *Publication*: Wee Sun Lee. NUS Differentiable Algorithm Networks for Composable Robot Learning , Robotics: Science and Systems 2019



Quantum Sensing Technologies Based On Multiboson Interferometry

- *Knowledge Transfer*: Naval Postgraduate School
- *Publication (submitted)*: Distributed Quantum Metrology with a Single Squeezed-Vacuum Source
- *Publication (submitted)*: Interference of multiple temporally distinguishable photons using frequency-resolved detection

Ship Type Identification From Learned Satellite Image Databases

- *Knowledge Transfer*: Technology presented to NMIO stakeholders.
- *TRL Progression*: TRL1 (Concept and general purpose GAN technology) to TRL4 (Application of GAN to ship classification using low-resolution satellite imagery)

Sonar Image Enhancement For Fly-By Mission

- *Publication*: B. Kim, J. Kim, M. Lee, M. Sung and S. Yu, "Active Planning of AUVs for 3D Reconstruction of Underwater Object using Imaging Sonar," 2018 IEEE/OES Autonomous Underwater Vehicle Workshop (AUV), Porto, Portugal, 2018, pp. 1-6. doi: 10.1109/AUV.2018.8729706. <https://ieeexplore.ieee.org/document/8729706>.
- *Publication*: H. Joe and S. Yu, "Submap based Normal Distribution Transform Scan Matching by using Heterogeneous Sonars for AUV Navigation," 2018 IEEE/OES Autonomous Underwater Vehicle Workshop (AUV), Porto, Portugal, 2018, pp. 1-6. doi: 10.1109/AUV.2018.8729734. <https://ieeexplore.ieee.org/abstract/document/8729734>

Synergetic Electron Transfer From Dual Species Biofilm In Anaerobic Conductive Sediment

- *Knowledge Transfer*: Technology presented at NRE Program Review.
- *Publication*: Divya Naradasu, Waheed Miran, Mitsuo Sakamoto, Akihiro Okamoto. Isolation and Characterization of Human Gut Bacteria Capable of Extracellular Electron Transport by Electrochemical Techniques. *Frontiers in Microbiology*. 9 (2019) 10.3389/fmicb.2018.03267.
- *Publication*: Muralidharan Murugan, Waheed Miran, Takuya Masuda, Dae S. Lee, Akihiro Okamoto. Biosynthesized Iron Sulfide Nanocluster Enhanced Anodic Current Generation by Sulfate Reducing Bacteria in Microbial Fuel Cells. *ChemElectroChem*. 5 [24] (2018) 4015-4020 10.1002/celc.201801086. <https://onlinelibrary.wiley.com/doi/full/10.1002/celc.201801086>
- *Publication*: Okamoto, A., Rowe, A., Deng, X., Nealson, K. H. Self-standing Electrochemical Set-up to Enrich Anode-respiring Bacteria On-site. *J. Vis. Exp.* (137), e57632, doi:10.3791/57632 (2018).
- *Publication*: Shu Zhang, Nancy Merino, Akihiro Okamoto, Phillip Gedalanga. InterKingdom Microbial Consortia Mechanisms to Guide Biotechnological Applications. *Microbial Biotechnology*. [5] (2018) 833-847. <https://onlinelibrary.wiley.com/doi/full/10.1111/1751-7915.13300>
- *Publication*: Xiao Deng, Akihiro Okamoto. Electrode Potential Dependency of Single-Cell Activity Identifies the Energetics of Slow Microbial Electron Uptake Process. *Frontiers in Microbiology*. 9 (2018) 10.3389/fmicb.2018.02744. <https://doi.org/10.3389/fmicb.2018.02744>
- *Publication*: Xiao Deng, Naoshi Dohmae, Kenneth H. Nealson, Kazuhito Hashimoto, Akihiro Okamoto. Multi-heme cytochromes provide a pathway for survival in energy-limited environments. *Science Advances*. 4 [2] (2018) eaao5682 10.1126/sciadv.aao5682. <https://advances.sciencemag.org/content/4/2/eaao5682>

Research Grant

OUTCOMES & RESULTS

(Sample)

Synergetic Electron Transfer From Dual Species Biofilm In Anaerobic Conductive Sediment (cont.)

- *Publication:* Y Tokunou, A Okamoto (2019) Geometrical Changes in the Hemes of Bacterial Surface c-Type Cytochromes Reveal Flexibility in Their Binding Affinity with Minerals. *Langmuir* 2019 35 (23), 7529-7537.
<https://pubs.acs.org/doi/pdfplus/10.1021/acs.langmuir.8b02977>
- *Publication:* Yoshihide Tokunou, Keisuke Saito, Ryo Hasegawa, Kenneth H. Nealson, Kazuhito Hashimoto, Hiroshi Ishikita, Akihiro Okamoto, Basicity of N5 in semiquinone enhances the rate of respiratory electron outflow in *Shewanella oneidensis* MR-1, *bioRxiv* 686493; doi: <https://doi.org/10.1101/686493>
- *Publication:* Yoshihide Tokunou, Punthira Chinotaikul, Shingo Hattori, Thomas A. Clarke, Liang Shi, Kazuhito Hashimoto, Kazuyuki Ishii, Akihiro Okamoto. Whole-cell circular dichroism difference spectroscopy reveals an in vivo-specific deca-heme conformation in bacterial surface cytochromes. *Chemical Communications*. 54 [99] (2018) 13933-13936 10.1039/c8cc06309e.
<https://pubs.rsc.org/en/content/articlehtml/2018/cc/c8cc06309e>

Taxonomy and Mechanistic Studies of Bio-luminescent Fungi

- *Publication:* Falaschi et al. (2019) *Neoceroplatus Betaryiensis* Nov. Sp. (Diptera: Kerplataidae is the first record of a bioluminescent fungus-gnat in South America. *Sci. Rep.* 9: 11291.
- *Publication:* Kaskova et al. (2017) Mechanism and color modulation of fungal bioluminescence *Sci. Adv.* 3: e1602847
- *Publication:* Kotlobay et al. (2018) Genetically encodable bioluminescent system from fungi. *Proc. Natl. Acad. Sci. U.S.A* 115: 12728-12732

Vision Enhancement Using Eye-Trackd Augmented Reality

- *Knowledge Transfer:* NRE collaboration anticipating widespread augmented reality: Insights from the 2018 AR visioning workshop. Technical report, University of Central Florida and Office of Naval Research, August 6 2019.
- *Knowledge Transfer (University Research):* Augusta University on using Virtual Reality for post-stroke rehabilitation.
- *Knowledge Transfer (University Research):* University of California Santa Barbara: Hired a student co-advised to work on user state detection, context dependent interaction, and AR based learning.
- *Knowledge Transfer (University Research):* University of Munich Co-advising thesis of a Masters student's "Augmented reality assistant to support button selection for patients with age-related macular degeneration", which the software developed will be used at Augusta University to help develop more in-depth visual deficit simulations by the computer science students at the Georgia Cyber Center.
- *Publication:* Liu, C., Plopski, A., Kiyokawa, K., Ratsamee, P., & Orlosky, J. (2018, October). IntelliPupil: Pupillometric light modulation for optical see-through head-mounted displays. In 2018 IEEE International Symposium on Mixed and Augmented Reality (ISMAR) (pp. 98-104). IEEE.
- *Publication:* Orlosky, J. (2019). Current Directions of Head Mounted Display Research. To appear in the Journal of the Virtual Reality Society of Japan. Invited paper.
- *Publication:* Orlosky, J., Liu, C., Kalkofen, D., Kiyokawa, K. (2019). Visualization-Guided Attention Direction in Dynamic Control Tasks. To appear in the proceedings of The International Symposium on Mixed and Augmented Reality 2019, Poster, 2 pages.



Vision Enhancement Using Eye-Tracked Augmented Reality (cont.)

- *Publication:* Techasartikul, N., Ratsamee, P., Orlosky, J., Mashita, T., Uranishi, Y., Kiyokawa, K., Takemura, T. (2019). Evaluation of Pointing Interfaces with an AR Agent for Multi-section Information Guidance. To appear in the proceedings of IEEE Virtual Reality 2019, Poster, 2 pages.
- *Publication:* Thomason, J., Ratsamee, P., Orlosky, J., Kiyokawa, K., Mashita, T., Uranishi, Y., & Takemura, H. (2019). A Comparison of Adaptive View Techniques for Exploratory 3D Drone Teleoperation. ACM Transactions on Interactive Intelligent Systems (TiiS), 9(2-3), 17.
- *Publication:* Zhang, L., Orlosky, J. (2019) Thermal HDR: Applying High Dynamic Range Rendering for Fusion of Thermal Augmentations with Visible Light. To appear in the proceedings of IEEE Virtual Reality 2019, Poster, 2 pages.
- *Publication (submitted):* Orlosky, J., Huynh, B., Höllerer, T. (2019). Using Eye Tracked Virtual Reality to Classify Understanding of Vocabulary in Recall Tasks. Submitted to Artificial Intelligence & Virtual Reality 2019. (Under Review)

Zero-Power Sensing for Underwater Monitoring

- *Publication:* P. Mayer, M. Magno, L. Benini. Self-Sustaining Acoustic Sensor With Programmable Pattern Recognition for Underwater Monitoring. IEEE Transactions on Instrumentation and Measurement, 2019.



ONR GLOBAL REGIONAL SUMMARY 2019

WHERE GLOBAL CONNECTED THIS YEAR...

THE AMERICAS

Argentina	Costa Rica
Bolivia	Ecuador
Brazil	El Salvador
Canada	Dominican Republic
Chile	Mexico
Colombia	Peru

MIDDLE EAST/AFRICA

Kenya
Oman
Qatar
Saudi Arabia
South Africa

EUROPE+

Austria	Latvia
Belgium	Luxembourg
Croatia	Netherlands
Czech Republic	Norway
Denmark	Poland
Finland	Portugal
France	Romania
Georgia	Serbia
Germany	Slovenia
Greece	Spain
Hungary	Sweden
Ireland	Switzerland
Israel	Ukraine
Italy	United Kingdom

INDO-PACIFIC

Australia	New Zealand
Bangladesh	Philippines
Brunei	Republic of Korea
China	Russia (Far East)
India	Singapore
Indonesia	Taiwan
Japan	Thailand
Malaysia	Vietnam

